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APPENDIX.

Notes on Hybridity, designed as a Supplement to the memoir on that subject in the last number of this Journal. By SAMUEL GEORGE MORTON, M.D. In a letter to the Editors of Charleston Med. Journ. and Review.

PHILADELPHIA, *December* 15, 1850.

GENTLEMEN:—In my memoir, printed in the last number of your Journal, I have adverted to the great disadvantage I labor under, in being compelled to publish my facts and observations in an incomplete and disjointed form. Every day impresses me yet more forcibly with the extent of this disadvantage, which can only be obviated by a systematic re-publication of the whole subject. Meanwhile, I beg leave, contrary to my express determination, to add a few *notes*, supplementary to my last paper, on the phenomena of Hybridity.

1. Persons who have not studied the specific relations of animals, may suppose that my definition of *species—a primordial organic form*—is necessary to the doctrine of diversity of origin for our domestic animals. Such, however, is not the case; for I wish it to be distinctly understood, that the many zoologists who have adopted the latter view, have done so in what I have elsewhere called the *Linnœan sense:* or, in other words, in the common acceptation of the word *species*. My definition is offered, in the hope that it may cover the whole ground better than those which have preceded it—a point which Naturalists will decide for themselves.

2. That Cuvier himself was fully satisfied of the existence of hybrid races of some domestic animals, is evident by a reference to certain passages of his *Règne Animal*. For example, he questions whether the *goat* and the *sheep* can be *generically* distinct, inasmuch as they produce with each other a fertile cross-breed; or, in his own words, "qu' ils produisent avec elles *des métis feconds*."—(Règne Animal, I, p. 247.) The only difficulty in the mind of Cuvier was, that *two different genera* should give rise to prolific hybrids. He neither on that occasion, nor any where else, so far as I am informed, expressed any doubt with respect to such phenomena as the result of a commixture of different *species*. But be the goats and sheep generically distinct, or not, the cross between these animals is fully admitted by Cuvier in the passage above cited; and he further adduces, as a possible example of fertile hybridity among them, an entire breed, which is peculiar to Upper Egypt. I repeat, therefore, that the impressions of this great naturalist were not

opposed to the doctrine of fertile hybridity among domestic animals; and moreover, what he supposed to have occurred in Egypt, has actually been in progress in Chili for the greater part of a century, as demonstrated by Molina and Chevreul.

Account of a prolific progeny from a Deer coupled with a Ram. By CARL N. HELLENIUS.*

"The favor with which my account, given in 1790—concerning an offspring produced from a cross between the deer and a ram—was received, induces me also to furnish for the examination of the Royal Academy, my subsequent experiments with respect to this offspring and its peculiarities.

"After the deer (*Cervus capriolus*) was crossed in 1789, by the ram (*Ovis aries*) they were kept together; and every subsequent Spring, between the 6th and 10th of May, she brought forth a young one, the sex changing with the alternate year, so that during the four years she has borne two young ones of each sex. The color of the female was blackish brown, and otherwise like the mother. The color of the male was always quite white, like the sire. This latter hybrid attained to a great size during the first year. It has a white, straight horn, more resembling that of a he-goat than the ram, yet somewhat rounded, without the least tendency to branch at the points, which have changed only by increasing in size. At the same time, the female, like its mother, remains harmless.

"The first progeny of the ram and deer was a female, which was accidentally killed before her power of procreation had been tested. When, in the following year, the deer had produced a male, I caused him, so soon as he ceased to be a suckling, (which, with these animals, usually happens towards the end of September,) to be shut up with a ewe of the Finland breed. The experiment succeeded beyond my expectation; for, in midsummer following, the ewe (removing all my doubts about cross-breeding) bore a male, which, in color, proportions, and shape of the horns, was exactly like the sire. I obtained by this experiment, at least, in my own opinion, satisfactory evidence that the cross-breed between these two species could be propagated into a race. But it yet remained to ascertain how far the hybrid offspring could mutually couple and multiply.

"This opportunity was afforded me in 1792, when the deer, (for the third time with young) brought forth a female. After this female had left her dam early in the autumn, I coupled her with the male which the deer had borne in the past year, (1791) and which animal had already produced offspring with the Finland ewe during the past winter. On the 22d of May, a male animal was born, like the previous young of the mother-parent, yet fourteen days later. But, notwithstanding this difference of age, the two young animals became so much like each

* Translated by my friend, John Lambert, Esq., from Kongl. Vetens. Acad. nya Handlingar. Tom. xiv., Stookholm, 1794. (New memoirs of the Royal Swedish Academy of Stockholm.

other in the course of the summer, that no one but their respective mothers could distinguish them.

"The male offspring of the deer's first progeny, with the Finland ewe, was shut up with his mother during the winter, and became the father of a white ewe, which was born about the end of June.

"I have thus from this pair (the deer and ram) obtained *seven offspring*, viz:

"*Four* from the deer and ram, two of each sex.

"*Two* from the deer's first hybrid male offspring, viz: by crossing this latter animal with the Finland ewe; and by crossing this same male with the female offspring of the deer and ram.

"*One*, a ewe, obtained by pairing the Finland ewe with one of her own progeny from the first hybrid male derived from the deer and ram."

M. Hellenius then gives an elaborate account of the form, fleece, and singularly mixed habits of these animals, which were in good health when his memoir was published, but I am compelled to leave this for a future occasion.

I may remark, however, that these facts show how readily a mixed race of deer and sheep might be obtained and perpetuated, by bringing together *many pairs* of both animals in the same flock, as has been done with the sheep and goats in Chili. Nor need we longer be incredulous of the production of a hybrid between the bull and the sheep, as mentioned by Prof. Owen of the Royal College of Surgeons, London: nor of the cross between the goat and lama, as recorded by Mattioli, in the *Memorie di Verona*, (t. viii, p. 121.) Moreover, the experiments of Hellenius prove incontestibly that animals of entirely different genera are capable of producing a fertile hybrid progeny; and they also prove that animals, not only of different species, but of different genera, can, *inter se*, give birth to hybrids, which may, in color, resemble either parent exclusively; thus showing that this phenomenon (whether in quadrupeds or birds) affords no evidence that the parents are of one species.

4. In an admirable HISTORY OF THE MAMMALIA, embracing six volumes of *Knights' Monthly Volume*, now printing in London, from the pens of Martin, Rennie, and other distinguished zoologists, I find the following account of the Ferret and Pole cat, and which is probably the latest published opinion respecting the relative position of these animals.

"The *Ferret* (Mustela furo) is closely allied to the *Pole cat*, (M. putorius); so closely, indeed, that many naturalists regard them as the same species, especially as a mixed breed between them may be procured. We do not, however, consider this opinion to be correct. The pole cat is a native of temperate and northern Europe, the ferret, of Africa, whence, as we are told by Strabo, it was imported into Spain, for the purpose of destroying rabbits, with which, at one period, that coun-

try was injuriously overrun. From Spain it spread through the rest of Europe, not as a wild, but as a domesticated animal." And the author then alludes to the mixed breed, which he says is preferred by the rat-catchers.—*Vol. ii, p.* 91, 1849.

The same views are expressed in Crespon's *Faune Meridionale*, just published in Paris.—*Vol. i, p.* 55.

5. The domestic hog, observes M. Jacquinot, "has been modified by crosses with other species, and, *among others*, with the Siamese pig, (*Sus indicus*) of which the typical wild species is yet found in New Guinea, in the Solomon Islands, and in many of the large islands of Oceanica. This last species having been introduced into Europe, has allied with the common breed, and thus given rise to numerous varieties."—*Voy. of the Astrolabe, L'Anthropologie, p.* 84. Here is a most satisfactory confirmation of the views of Col. Hamilton Smith, and an explanation of those otherwise paradoxical differences in the osteology of the hog, to which Mr. Eyton has called the attention of scientific men.*

6. M. Jacquinot observes, "that a principal cause of the varieties among domestic animals, *is the blending of dissimilar species among themselves;* and it is this powerful agency which has contributed, in the largest degree, to obscure and entangle the question of the varieties of Man and of domestic animals." He then applies to the latter the same proposition which Desmoulins applied to the Dogs; for, after expressing his conviction that different countries were furnished, each with its proper and peculiar type, he adds: "These types having wandered from their native climates in the train of man, have met with closely allied species. Crosses have thus occurred and new types have resulted, which, by uniting with the primitive stocks, have gradually modified them by a succession of hybrid mixtures"—p. 75.

7. A word more about the *Dogs*. Under this head, the following windy accusation is laid at my door: "You charge against Buffon, Linnæus, Cuvier, and all others who have regarded them as varieties, and give us nearly thirty true species."

I certainly do differ from all those naturalists who may regard several species of wolves, and many of dogs, as having descended from a single ancestral pair; and I feel myself well sustained in the *law of diversity of origin* as applied to these animals, when I find it sustained by such men as Azara, Pallas, Harlan, Ehrenberg, Fischer, Blyth, Agassiz, Schinz, Tchudi, Martin, Desmoulins, Hombron and Jacquinot. I adduce this augmented list of the first zoologists of the past and pre-

* "The hog of Siam, a species very distinct from our wild hog, is the same animal in Europe and in Oceanica."—*Jacquinot, op. citat.*, p. 40.

sent time, in order to prove to those who are not initiated into this subject, that I have committed no heresy in Science; but on the contrary, that I have the weight of zoological opinion and evidence on my side. Nay more; I am strongly disposed to believe, that were Buffon, Linnæus and Cuvier alive at this time, the accumulated facts of the case might induce them to revise their opinions on this question.

Another word for the *Wolves*. If I ever had a doubt before, I have none now, that the European wolf *is a totally distinct species* from the common grey wolf of America. This opinion, which appears to have originated with Buffon, has been proved correct by Sir John Richardson, and adopted by Mr. John Edward Gray, Prof. Agassiz, Dr. Dekay and Dr. Townsend; and I have now in progress a series of examinations and comparisons which, I feel confident, will remove all remaining doubts on this question.

A captious critic might take exception to a remark in my *Essay on Hybridity*, that "the pure Indian dogs *are of one variety* with erect ears, a wolfish aspect, and having a howl in place of a bark." I alluded in this instance to the *common Indian dog*, as described by Carver, De Weid, Say, and others, as the context will show. I was not then aware of the fact that this very dog is a hybrid. I had looked in vain for full information respecting this animal, and the aboriginal dogs of Mexico and South America; whence arose the concluding remark of the paragraph in question: "It is much to be regretted that so little is known of the history of the *indigenous dogs of America*—a subject that affords a fine field for scientific inquiry." To this inquiry, I have been compelled to turn my attention, and the results have amply rewarded the labor it has cost me, although much yet remains to be accomplished.

8. Many of the most distinguished ethnologists have regarded *mankind* as composed of various distinct *species* in the *Linnæan acceptation;* and among them are Charles White, Virey, Rudolphi, Desmoulins, Bory de St. Vincent, Fischer, Malte Brun, Caldwell, Gerdy, Nott, Dugés, Hamilton Smith, Hombron, Jacquinot and Knox. Virey makes two species only; others three or five. Some zoologists propose a larger number, having a relation to the primitive centres of creation. The *primitive varieties* of Prof. Agassiz are identical with the specific forms of some of his contemporaries; and my own views have been expressed on a former occasion.

M. Jacquinot cites the infrequency of hybrid offspring among certain dissimilar human species, in evidence of the plurality of origin; and he especially quotes the facts relative to the intercourse between the Europeans and Australians, in New Holland.

"Those tribes which inhabit the environs of Port Jackson, diminish in number every day (vont chaque jour en décroissant,) and it is a rare occurrence to see an individual of the cross-breed between the Australians and Europeans. This absence of hybrids of two races living in contact on the same soil, is an incontestible evidence of a difference of species."—*Jacquinot, Voy. de l'Astrolabe. Zoologie, ii. p.* 109.

And this distinguished zoologist then applies the same remark to the inhabitants of Van Dieman's Land, among whom the occurrence of hybrid offspring is said to be yet more unfrequent.

"Wild, visionary and pitiable theories," says Dr. Knox, "have been offered respecting the colour of the black man, as if he differed only in colour from the white races. But he differs in every thing as much as in colour. He is no more a white man than a horse is an ass or a zebra."—*Races of Men, p.* 163. 1850.

These remarks of Dr. Knox may, at first view, seem harshly expressed; but the question arises, whether the two extremes of the *genus Homo*, as represented by the Anglo-Saxons and Australians are not as different from each other as two species of equine animals? Is the hybrid any more prolific in the one case than in the other?

9. *Hybrid Fishes.*—Having lately met with a letter from Sir Anthony Carlisle, addressed to Mr. Alexander Walker, in reference to certain hybrid fishes, I shall transcribe the greater part of it from *Walker on Intermarriage, p.* 213. The letter is dated in London, 1837.

"More than thirty years since, the breeding of trout was tried by impregnating their ova in confined water cages, made to protect the young against their natural enemies. As I had some share in these experiments, I undertook to try to breed those mule fishes, known to be a produce between male trouts and salmon roe, or the reverse. I accordingly procured a quart jug full of ripe salmon-roe, from the freshest fish arrived at Billingsgate in the month of January; and I proceeded with them direct to Carshalton, where they were carefully deposited by a man who waded into the stream, and raked the ova among the gravel in the trout-spawning gravel heaps.

In the month of April, a new sort of fish appeared, for the first time, in that river, which proved to be the mules called *skeggers* in the Thames, *smelts* in the North of England rivers, and *gravel-last-springs* in many of the Western and Southern countries. They were, in this case, very abundant; and apparently their numbers corresponded with the salmon-spawn deposited in the trout gravel-hill.

"These mules never appear but where salmon invade the breeding gravel hills of trout; and, in my experiment, the impregnators were necessarily male trouts, because salmon never pass the mills upon the Wandle. These mules partook of the character of trout more than of salmon. They grew to the length of the male parent, and to the weight of a quarter of a pound."

It thus appears that mule fishes are not only obtained by artificial

processes, but they are spontaneously produced in nature on a very large scale.

10. *Hybrid Plants.*—"I can perfectly comprehend, without altogether sharing the opinion," observes DeCandolle, "that where many species of the same genera occur near together, hybrid species may be formed; *and I am aware that the great number of species of certain genera which are found in particular regions, may be explained in this manner;* but I am unable to conceive how any one can regard the same explanation as applicable to species which live naturally at great distances." Quoted in *Lyell's Principles of Geology, chap. xxxvii.*

It therefore appears that the greatest Botanist of the present century, had no hesitation in admitting the possibility if not the actual existence, of a *great number* of hybrid plants in a perfectly natural state.

11. *Fragments from Hombron.*—"We see in the *Zebu*, not a variety of our common cattle, but a distinct species." P. 99.

"We have already spoken of the fecundity of the hybrids between the camel and dromedary. We have arrived at the conclusion, that by the intervention of man, proximate species are capable of producing *a race*, and that the fertility of this race is not a proof of the identity of the species which have produced it. We have seen that the *Lama* and the *Alpaca*, the *Alpaca* and the *Vigogna*, and the *Guanaco*, with each of the others, reproduce freely, and will some day give rise to hybrid flocks, formed of very different races. Hence, if we did not know to the contrary, all these animals, as in our domestic breeds of sheep, would hereafter be referred to a single source, which had been perverted (défigurée) by artificial means." P. 113.

"There are many species of men. The divine revelation had, in Moses, a faithful interpreter. But although he does not expressly record the fact, every thing tends to the belief that the intellectual man was not created until after the savage, who therefore had precedence on the earth. This gradual creation and development of mankind, is in perfect accordance with the other phenomena of our earth, wherein every thing obeys the law of succession. Genesis confines itself to the origin and dispersion of the people of God, who were the *Syro-Arabian species.*" Pp. 28, 29.

12. *Fragments from Jacquinot.*—"If the great branches of the human family have remained distinct in the lapse of ages, with their characteristics fixed and unalterable, we are justifiable in regarding mankind as divisible into *distinct species.*" P. 36.

"Variations of colour have no influence on specific characters." P. 43.

"Cuvier himself did not hesitate to regard some of our domestic animals as derived from many different species." P. 71.

"There can be no doubt the varieties of the dog have been derived from many primitive types." P. 79.

"It is our opinion that the *Zebu*, an animal of only warm climates, and found only in them, pertains to a distinct species." P. 83.

Among the domestic fowls, "we know at present three wild species, which may be regarded as the originals of our barn-yard varieties, viz: *Gallus Sonneratii*, *G. Bankiva* and *G. gigantæus*.* The union of these species among themselves could give rise to the multitude of varieties of colour and of form, to which the state of domestication has added its own results, as seen in melanism, albinism, and monstrosities of every kind." P. 86.

"Among mankind the species are proximate, (très-voisines;) and, according to the law already explained, that the nearer two species are to each other, the greater is the chance of fecundity—the hybrid offspring of these crosses will possess a certain degree of reproduction however; but here, as among the inferior animals, the rule is not absolute." P. 91.

"The definition of *species* as given by Ray, and after him by Buffon—that all animals are to be regarded as of the same species, which are capable of producing with each other a fertile offspring, is not accurate." (*N'est point exacte.*) P. 91.

P. S. To those persons who are desirous to become acquainted with the present state of Ethnology, I commend the two following works, which, in my opinion, embrace more of the truthful results and real philosophy of the science, than most of the other systematic works that have been published on the subject; at the same time that, as a treasury of facts, Dr. Prichard's immortal work must take precedence over all others.

I have also great pleasure in referring to the *Races of Man* of my friend Dr. Pickering, in which the facts are the result of personal observation.

Jacquinot, Considérations générales sur l'Anthropologie. Paris, 1846. 1 vol. 8vo.

Hombron, L'Homme dans ses rapports avec la création. Paris, 1846. 1 vol. 8vo.

It is enough to say that these gentlemen were the Zoologists of the late *Voyage of the Astrobale*, and that they received their instructions from the illustrious De Blainville.

With respect to the effects of real *in-and-in* breeding among animals, man included, consult Walker *on Inter-marriage*. London. 1841.

For many collateral questions, I have great pleasure in again referring to the *Rev. John Pye Smith's Lectures* on the Relation between the Holy Scriptures and Geological Science, lately re-published in this city by Mr. R. E. Peterson.

* *Coq varié*, which I suppose to be the *G. gigantæus*.